Reference vs Object vs Instance vs Class

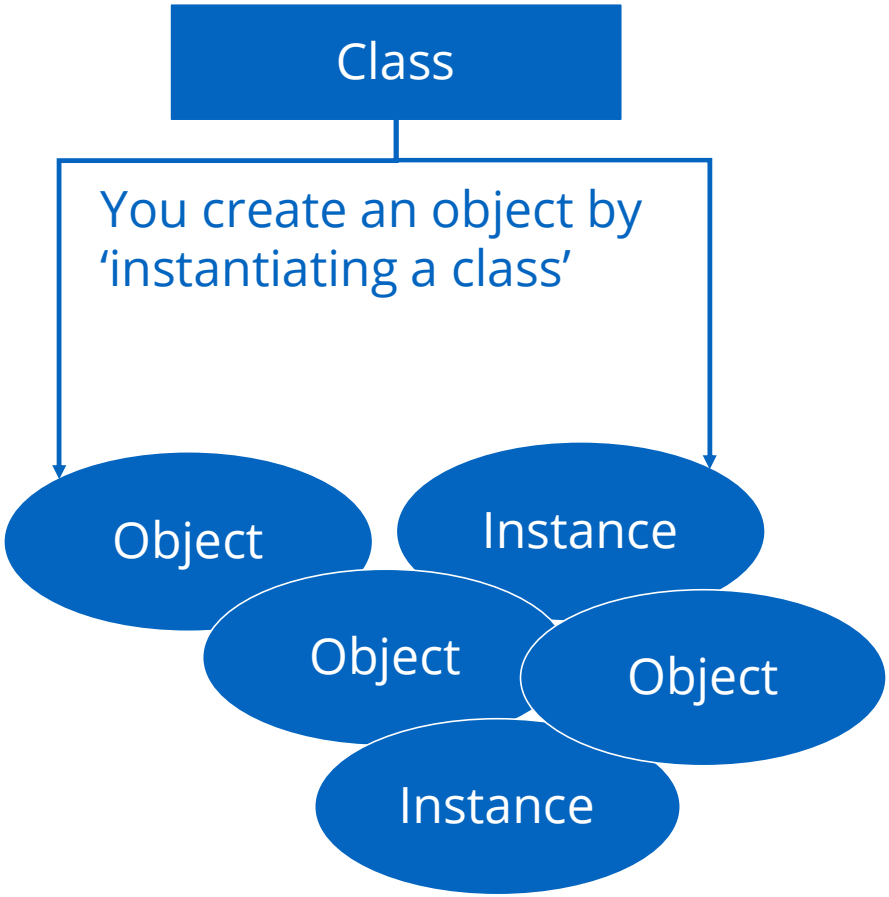
In this video, we're going to talk about references, vs. objects, vs. instances, vs. classes.

Reference vs Object vs Instance vs Class

We use the words, **reference**, **object**, **instance** and **class**, quite a lot when talking about Java code.

These new concepts may well be confusing at first.

Object vs Instance vs Class



You can create many objects using a single class. Each may have unique attributes or values

Object and instance are interchangeable terms

Reference vs Object vs Instance vs Class

Let's use the analogy of building a house to understand classes.

A class is basically a blueprint for the house.

Using the blueprint, we can build as many houses as we like, based on those plans.

Each house we build (in other words using the new operator) is an object.

This object can also be known as an instance, often we'll say it's an instance of the class. So we would have an instance of house in this example.

Each house we build has an address (a physical location).

In other words, if we want to tell someone where we live, we give them our address (perhaps written on a piece of paper). This is known as a reference.

Reference vs Object vs Instance vs Class

We can copy that reference as many times as we like, but there is still just one house that we're referring to.

In other words, we're copying the paper that has the address on it, not the house itself.

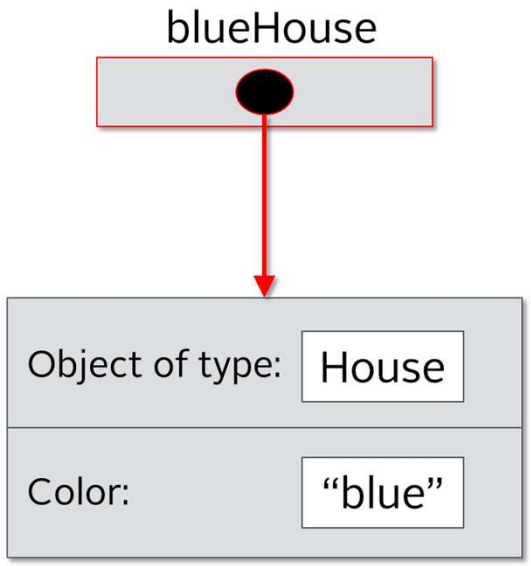
We can pass references as parameters to constructors and methods.

Reference vs Object vs Instance vs Class

```java
public class House {

    private String color;

    public House(String color) {
        this.color = color;
    }

    public String getColor() {
        return color;
    }

    public void setColor(String color) {
        this.color = color;
    }
}
```

```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("red");
        System.out.println(blueHouse.getColor()); // red
        System.out.println(anotherHouse.getColor());// red

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //red
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

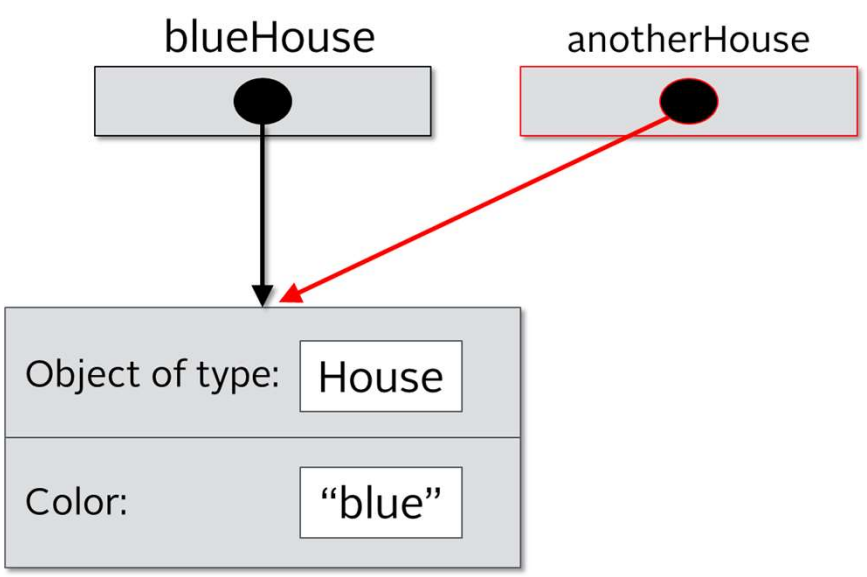
Reference vs Object vs Instance vs Class




```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("red");
        System.out.println(blueHouse.getColor()); // red
        System.out.println(anotherHouse.getColor());// red

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //red
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

The line **House blueHouse = new House(“blue”);** creates a new **instance** of the House **class**. Remember House is a blueprint, and we are assigning it to the blueHouse **variable**. In other words it is a **reference** to the **object** in memory. The image on the left hopefully makes sense to you now.

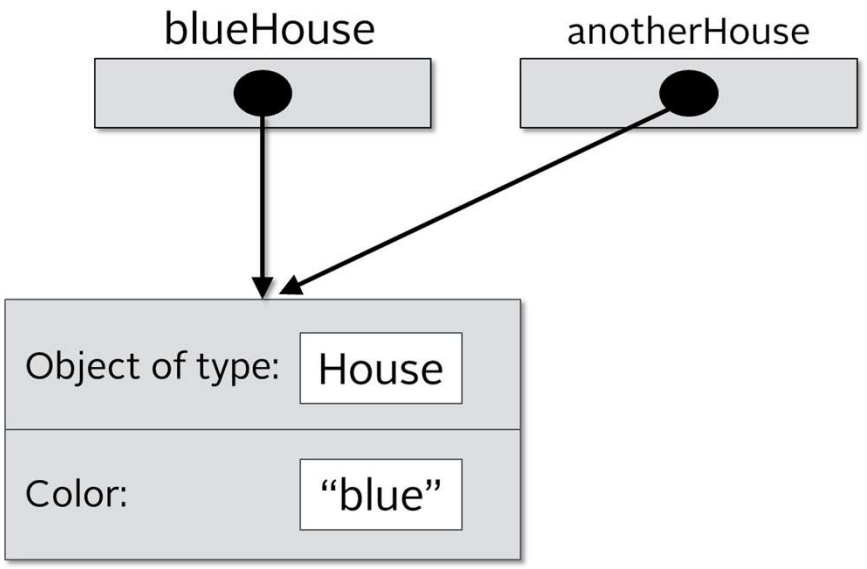
Reference vs Object vs Instance vs Class




```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("red");
        System.out.println(blueHouse.getColor()); // red
        System.out.println(anotherHouse.getColor());// red

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //red
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

The next line **House anotherHouse = blueHouse;** creates another **reference** to the same **object** in memory. Here we have two **references** pointing to the same object in memory. There is still one house, but two **references** to that one **object**. In other words we have two pieces of paper with the physical address of where the house is built (going back to our real world example).

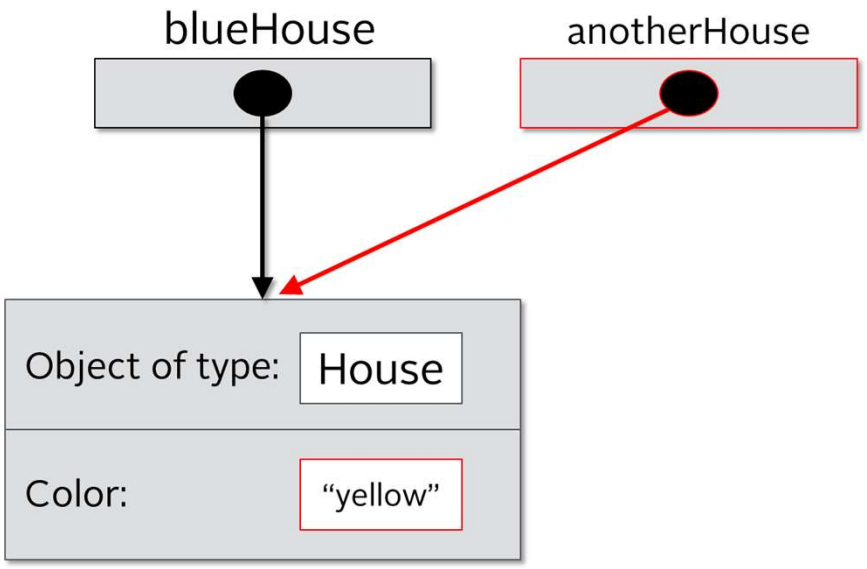
Reference vs Object vs Instance vs Class




```
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("red");
        System.out.println(blueHouse.getColor()); // red
        System.out.println(anotherHouse.getColor());// red

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //red
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

Next we have two println statements that print the blueHouse color and anotherHouse color. Both will print “blue” since we have two **references** to the same **object**.

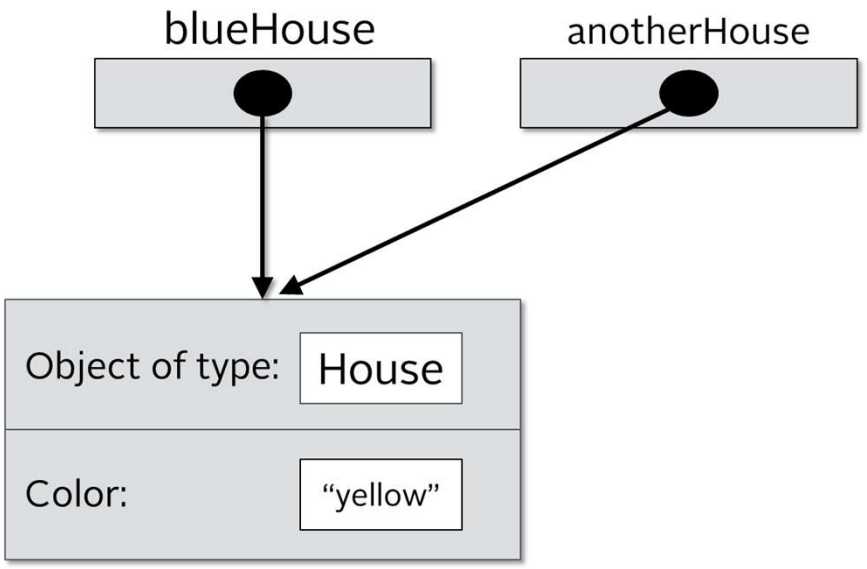
Reference vs Object vs Instance vs Class




```
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("yellow");
        System.out.println(blueHouse.getColor()); // yellow
        System.out.println(anotherHouse.getColor());// yellow

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //yellow
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

The next line calls the method setColor and sets the color to yellow. To the left you can that both blueHouse and anotherHouse have the same color now. Why? Remember we have two **references** that point to the same **object** in memory. Once we change the color, of one, **both references** still point to the same **object**. In our real world example, there is still just one physical house at that one address, even though we have written the same address on two pieces of paper.

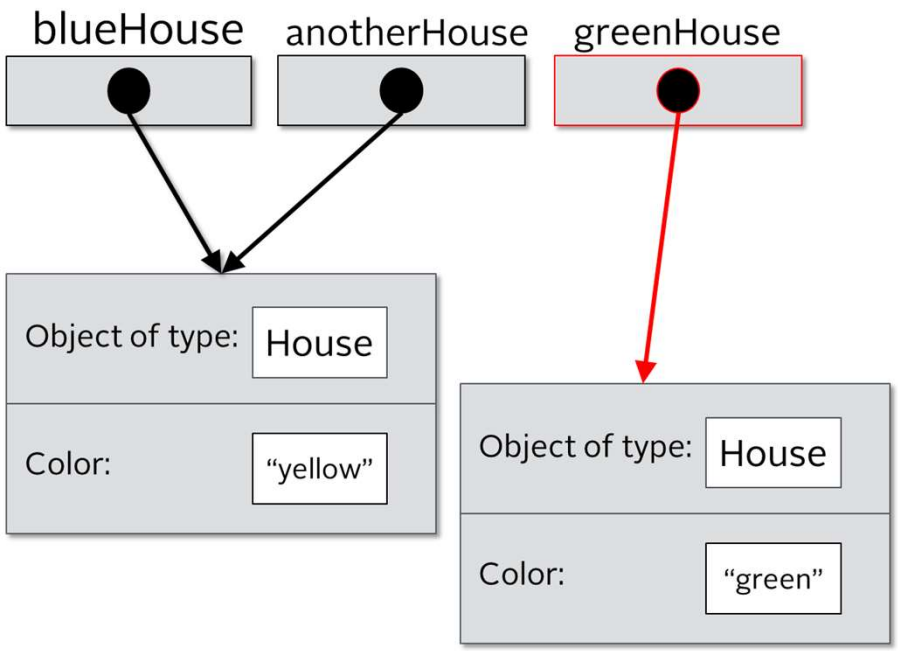
Reference vs Object vs Instance vs Class




```
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("yellow");
        System.out.println(blueHouse.getColor()); // yellow
        System.out.println(anotherHouse.getColor());// yellow

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //yellow
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

Here we have two println statements that are printing the color. Both now print “yellow” since we still have two **references** that point to the same **object** in memory. Notice the arrows on the left hand side.

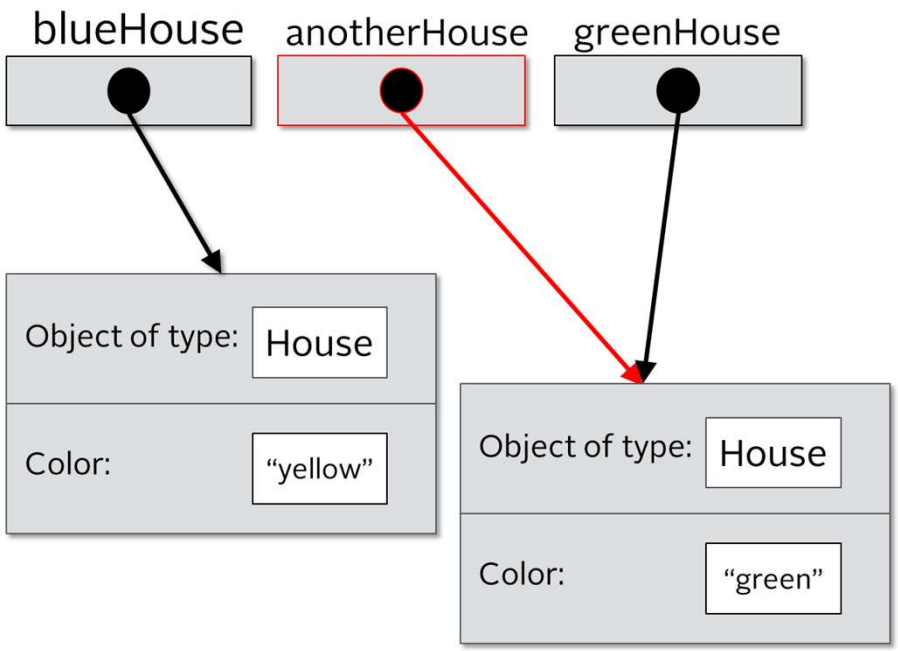
Reference vs Object vs Instance vs Class




```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("yellow");
        System.out.println(blueHouse.getColor()); // yellow
        System.out.println(anotherHouse.getColor());// yellow

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //yellow
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

Here we are creating another new instance of the House class with the color set to "green". Now we have two **objects** in memory but we have three **references** which are blueHouse, anotherHouse and greenHouse. The variable (**reference**) greenHouse points to a different **object** in memory, but blueHouse and anotherHouse point to the same object in memory.

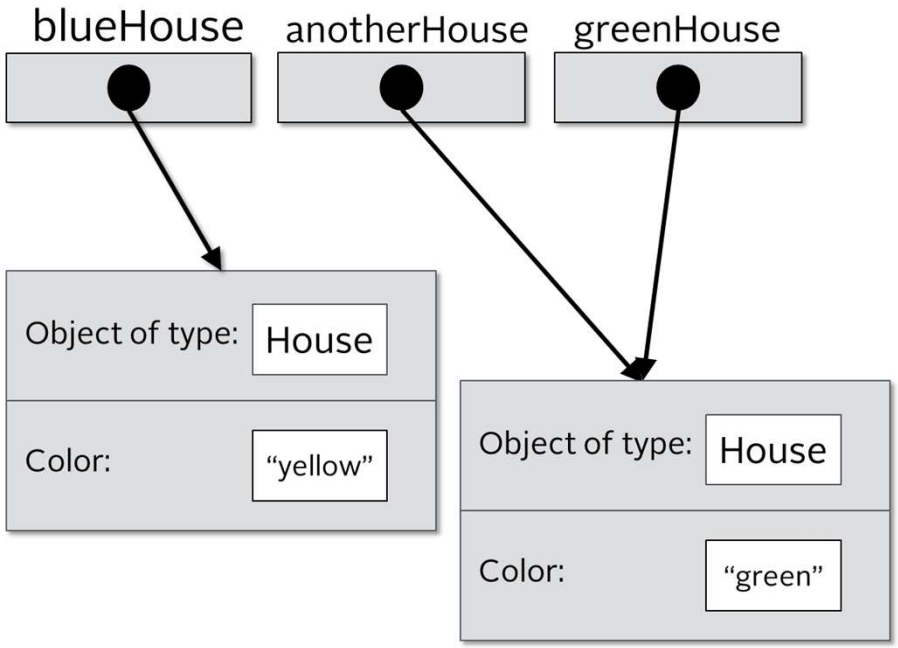
Reference vs Object vs Instance vs Class




```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("yellow");
        System.out.println(blueHouse.getColor()); // yellow
        System.out.println(anotherHouse.getColor());// yellow

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //yellow
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

Here we assigns greenHouse to anotherHouse. In other words we are dereferencing anotherHouse. It will now point to a different **object** in memory. Before it was pointing to a house that had the "yellow" color, now it points to the house that has the "green" color. In this scenario we still have three **references** and two **objects** in memory but blueHouse points to one **object** while anotherHouse and greenHouse point to the same **object** in memory.

Reference vs Object vs Instance vs Class




```java
public class Main {

    public static void main(String[] args) {

        House blueHouse = new House("blue");
        House anotherHouse = blueHouse;

        System.out.println(blueHouse.getColor()); // prints blue
        System.out.println(anotherHouse.getColor());// blue

        anotherHouse.setColor("yellow");
        System.out.println(blueHouse.getColor()); // yellow
        System.out.println(anotherHouse.getColor());// yellow

        House greenHouse = new House("green");
        anotherHouse = greenHouse;

        System.out.println(blueHouse.getColor()); //yellow
        System.out.println(greenHouse.getColor());// green
        System.out.println(anotherHouse.getColor());// green
    }
}
```

Finally we have three println statements. The first will print "yellow" since the blueHouse **variable(reference)** points to the **object** in memory that has the "yellow" color, while the next two lines will print "green" since both anotherHouse and greenHouse point to same **object** in memory.

The reference vs The object

Consider the code on this slide.

```
1    new House("red");                    // house object gets created in memory
2    House myHouse = new House("beige");  // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to myHouse
3    House redHouse = new House("red");   // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to redHouse
```

On the first line, we create a new House, and make it red.

But we aren't assigning this to any variable.

The reference vs The object

```
1    new House("red");                    // house object gets created in memory
```

This compiles fine, and you can do this.

This object is created in memory, but after that statement completes, our code has no way to access it.

The object exists in memory, but we can't communicate with it, after that statement is executed.

We didn't create a reference to it.

The reference vs The object

We create a reference to the house object we created.

```
2       House myHouse = new House("beige");      // house object gets created in memory
                                                 // and it's location (reference) is
                                                 // assigned to myHouse
```

Our reference, myHouse, lets us have access to that beige house, as long as our variable, myHouse, stays in scope.

The reference vs The object

We're creating a red house again, but this is a different object altogether, from the red house we created on line one.

```
3    House redHouse = new House("red");          // house object gets created in memory
                                                 // and it's location (reference) is
                                                 // assigned to redHouse
```

This statement is creating another house object in memory, which has no relationship to the one we created on the first line.

```
1    new House("red");                           // house object gets created in memory
2    House myHouse = new House("beige");         // house object gets created in memory
                                                 // and it's location (reference) is
                                                 // assigned to myHouse
```

The reference vs The object

```
1    new House("red");                    // house object gets created in memory
2    House myHouse = new House("beige");  // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to myHouse
3    House redHouse = new House("red");   // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to redHouse
```

So this code has three instances of house, but only two references.

That first object is said to be eligible for garbage collection, immediately after that first statement.

It's no longer accessible.

The reference vs The object

```
1    new House("red");                    // house object gets created in memory
2    House myHouse = new House("beige");  // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to myHouse
3    House redHouse = new House("red");   // house object gets created in memory
                                          // and it's location (reference) is
                                          // assigned to redHouse
```

There are times we might want to instantiate an object, and immediately call a method on it.

But 99% of the time, we'll want to reference the objects we create.